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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. _____

First Inventor or Application Identifier _____

Title _____

Express Mail Label No. _____

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

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1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages **9**]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. **3** Drawing(s) (35 U.S.C. 113) [Total Sheets **1**]
4. Oath or Declaration [Total Pages **10**]
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☐ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney
(when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☒ * Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
(PTO/SB/09-12)
14. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. ☐ Other: _____

* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)

of prior application No. _____

Prior application information: Examiner _____

Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label


(Insert Customer No. or Attach bar code label here)

or ☒ Correspondence address below

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Country	USA	Telephone	480-460-3431	Fax	480-517-1154

Name (Print/Type)	William J. PERCIBALLI	Registration No. (Attorney/Agent)	
Signature	WJ Perciballi	Date	2/14/2000

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TRANSMITTAL FORM <i>(to be used for all correspondence after initial filing)</i>	Application Number		
	Filing Date	2/14/2000	
	First Named Inventor	PERCIBALL, WILLIAM J	
	Group Art Unit		
	Examiner Name		
Total Number of Pages in This Submission	16	Attorney Docket Number	

ENCLOSURES (check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form	<input type="checkbox"/> Assignment Papers (for an Application)	<input type="checkbox"/> After Allowance Communication to Group
<input checked="" type="checkbox"/> Fee Attached	<input checked="" type="checkbox"/> Drawing(s)	<input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences
<input type="checkbox"/> Amendment / Response	<input type="checkbox"/> Licensing-related Papers	<input type="checkbox"/> Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
<input type="checkbox"/> After Final	<input type="checkbox"/> Petition Routing Slip (PTO/SB/69) and Accompanying Petition	<input type="checkbox"/> Proprietary Information
<input type="checkbox"/> Affidavits/declaration(s)	<input type="checkbox"/> Petition to Convert to a Provisional Application	<input type="checkbox"/> Status Letter
<input type="checkbox"/> Extension of Time Request	<input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address	<input type="checkbox"/> Additional Enclosure(s) (please identify below):
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<input type="checkbox"/> Information Disclosure Statement	<input checked="" type="checkbox"/> Small Entity Statement	
<input type="checkbox"/> Certified Copy of Priority Document(s)	<input type="checkbox"/> Request for Refund	
<input type="checkbox"/> Response to Missing Parts/Incomplete Application	Remarks	
<input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT	
Firm or Individual name	William J. PERCIBALLI
Signature	W. Perciballi
Date	2/14/2000

CERTIFICATE OF MAILING			
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on this date: <input type="text"/>			
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**STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))—INDEPENDENT INVENTOR**

Docket Number (Optional)

Applicant, Patentee, or Identifier: PERCIBALLI, William J.

Application or Patent No.: _____

Filed or Issued: _____

Title: Ceramic Armor Apparatus for Multiple Bullet Protection

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.
☒ the application identified above.
☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.
☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

PERCIBALLI		
<u>William J. Perciballi</u>		
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
<u>W. Perciballi</u>		
Signature of inventor	Signature of inventor	Signature of inventor
<u>2/14/2000</u>		
Date	Date	Date

Ceramic Armor Apparatus for Multiple Bullet Protection

BACKGROUND OF THE INVENTION

Field of the Invention

10

This invention relates to ceramic armor and, more particularly, to a single ceramic armor for protecting against multiple small arms bullets.

Description of the Prior Art

15

Ceramic armor is typically used for body armor and for the outer coverings of different types of vehicles, such as various types of land vehicles, ships, and aircraft. Typically, ceramic tiles are adhesively secured to a substrate then encapsulated in an outer cover. The armor system is then attached to a vehicle by a variety of means or merely placed in a fabric pocket, as in the case of body armor.

20

An inherent problem is the prior art is that ceramic armor is configured for a fixed level of protection against a singular ballistic threat.

25

The apparatus of the present invention overcomes the deficiencies of the prior art by providing a single arrangement of ceramic and substrate to provide protection against a variety of bullets. The appropriate ceramic and substrate arrangement provides protection against both lead-filled and steel-filled bullets with calibers of 5.56mm and 7.62mm, which are the common calibers used by military and civilian rifles.

The apparatus may be used with or without a supplementary armor system such as a body armor vest or the outer skin of a vehicle. Stealth and other features, such as durability, drop protection, field abuse, spall mitigation, etc., may also be included in the apparatus.

SUMMARY OF THE INVENTION

The invention described and claimed herein comprises a Boron Carbide ceramic facing bonded to an Aramid fiber composite substrate. The ceramic facing element may consist of a plurality of elements, such as tiles, or may be a singular ceramic plate that is either flat or molded to the desired shape. The aramid fiber composite substrate is comprised of a plurality of layers of aramid fibers arranged in either fabric or uni-directional tape structures. The aramid fiber substrate layers are stacked to achieve the desired thickness and protection, and are laminated using a variety of polymer compounds to create a singular element. The aramid fiber substrate is arranged to be generally parallel to the ceramic facing element such that the shape of the aramid fiber substrate mirrors that of the ceramic element.

Among the objects of the following invention are the following:

To provide a new and useful means of arranging ceramic tile armor elements disposed on a substrate;

5 To provide a new and useful ceramic armor system for protection against multiple ballistic threats;

To provide a new and useful means of minimizing the weight of a ceramic armor system for ballistic protection; and

To provide a new and useful means of creating a supplementary armor plate for
10 use in conjunction with an existing armor system.

BRIEF DESCRIPTION OF DRAWING

DRAWING FIGURES

15 Figure 1 is a perspective view of an embodiment of the apparatus of the present invention.

Figure 2 is a view in partial section taken generally along line 2-2 of Fig 1.

Figure 3 is a perspective view of an alternate embodiment of the apparatus of the
20 present invention.

REFERENCE NUMERALS IN DRAWINGS

Item 10 is the ceramic armor apparatus
Item 11 is a ceramic armor assembly comprised of Items 12, 13, and 14
25 Item 12 is the monolithic ceramic facing element
Item 13 is the adhesive element
Item 14 is the aramid fiber substrate element
Item 15 is the encapsulating cover
Item 16 is the optional rear portion of the encapsulating cover
30 Item 17 is the ceramic tile facing element
Item 18 is the ceramic tile facing element
Item 19 is the ceramic armor assembly comprised of Items 13,14,17, and 18
Item 20 is the ceramic armor apparatus alternate embodiment

DESCRIPTION OF PREFERRED EMBODIMENT

Figure 1 is a perspective view, partially broken away and in partial section, of the ceramic armor apparatus 10 of the present invention. Figure 2 is a view in partial section of the apparatus 10 taken generally along line 2-2 of Fig. 1. For the following discussion, reference will be made to Figs 1 and 2.

The ceramic armor apparatus 10 includes a cover 15 with the ceramic armor elements 11 deposited therein. The cover may include a back panel 16 that either partially or completely covers the rear surface of the plate. The cover may be comprised of a single material, such as nylon fabric, or may be a combination of fabric, rigid plastic, and foam that protects the ceramic from wear-and-tear and contains ceramic particles on impact as appropriate.

Within the ceramic armor elements 11 is the ceramic tile element 12, the adhesive layer element 13, and the aramid fiber composite substrate element 14. The ceramic tile element 12 may be made of any appropriate non-oxide ceramic material, for example, Boron Carbide, Silicon Carbide ceramics. Alternatively, a ceramic matrix composite or metal matrix composite containing Silicon Carbide or Boron Carbide particles may be used. Although ceramic thickness may be varied to suit a specific need, the preferred ceramic arrangement ranges from 0.080-inches to 0.269-inches in thickness.

Disposed against and roughly parallel to back 12 is the adhesive element 13 that forms a discreet layer.

The adhesive layer 13 may be made of any approximate polymer, for example. epoxy, polyurethane, polysulfide, polyolefin. The preferred thickness of the adhesive

5 layer is controlled to result in a thickness between 0.002-inches and 0.090-inches. For convenience, the adhesive layer illustrated in the drawing Figures are cross hatches as metal.

Disposed against the back 13, and roughly parallel to the back 12, is the aramid fiber composite substrate plate 14.

10 The substrate plate 14 may be made of any appropriate aramid fiber such as Kevlar® or Twaron®. Aramid fiber constructions such as fabrics, unidirectional tapes, felts, non-woven layers, or three-dimensional structures may be used. The substrate layer 14 is arranged to create a uniform structure that ranges from 0.130-inches to 0.350-inches in thickness.

15 The aramid fibers of substrate plate 14 are encased in a polymer matrix to form a rigid laminate. Virtually any appropriate polymer resin may be used for the matrix, for example Phenolic, Phenolic Polyvinyl Butyral rubber blends, Polyester, Vinylester, polyurethane, and polyolefin resins. For convenience, the aramid fiber substrate plates illustrated in the drawing Figures are cross hatches as metal.

20 When substrate plate 14 employs a polymer resin matrix, the preferred resin content ranges from fifteen to twenty-four percent by weight.

An alternate embodiment 20 of the present invention is illustrated in Fig.3.

Figure 3 comprises a perspective view, partially broken away and in partial section, of apparatus 20 of the present invention where the ceramic armor tile layer 19 comprises a
25 plurality of individual ceramic tiles as exemplified by elements 17 and 18. The ceramic elements 17 and 18 can be square ceramic tiles or otherwise shaped to suit the dimensional needs of a particular application.

5 The remainder of the Figure 3 elements are arranged and employed respectively
in a similar manner as shown in Figures 1 and 2.

10 WHAT I CLAIM IS:

1. Ceramic armor apparatus comprising in combination:

15 A ceramic facing element with thickness of 0.080-inches to
0.310-inches

 An adhesive layer with thickness ranging from 0.002-
inches to 0.090-inches

20 An aramid fiber composite substrate with thickness of
0.130-inches to 0.350-inches

2. The apparatus of claim 1 in which the armor provides protection
against the 5.56mm M193 bullet, the 5.56mm M855 bullet, the 5.56mm SS109
25 bullet, the 7.62mm M80 bullet, the 7.62mm LPS bullet, the 7.62mm PS bullet
either alone or in any combination thereof.

3. The apparatus of claim 1 where the ceramic facing in comprised of
Boron Carbide ceramic.

30 4. The apparatus of claim 1 where the ceramic facing is comprised of
Silicon Carbide ceramic.

5 5. The apparatus of claim 1 when the ceramic facing is comprised of
a ceramic matrix composite that contain either of the ceramic materials of claims
4 and 5 either alone or in combination.

10 6. The apparatus of claim 1 where the ceramic element is a
continuous monolithic plate that is generally flat, or with single, double, or
compound curvature.

15 7. The apparatus of claim 1 where the adhesive layer is comprised of
epoxy adhesive.

20 8. The apparatus of claim 1 where the adhesive layer is comprised of
polysulfide adhesive.

25 9. The apparatus of claim 1 where the adhesive is comprised of
polyurethane adhesive.

 10. The apparatus of claim 1 where the adhesive is comprised of
polyolefin materials.

 11. The apparatus of claim 1 where the fiber composite substrate is
comprised of aramid fibers with fineness ranging from 250- to 3,500-denier.

5

12. The apparatus of claim 1 where the aramid composite is comprised of aramid fiber fabrics in plain, basket, or twill weave styles with basis weights between 3.5- and 20.0-ounces-per-square-yard.

10

13. The apparatus of claim 1 where the aramid composite is comprised of aramid fiber unidirectional all tapes arranged in 0, 15, 30, 45, 60, 90-degree orientation or combinations thereof.

15

14. The apparatus of claim 1 where the aramid fiber backing is comprised of 3-dimensional structure that incorporates stitching or fiber axes along or about the z-axis of the fabric.

20

15. The apparatus of claim 1 through 15 where combined thickness of the ceramic, adhesive, and substrate elements falls in the range between 0.430-inches and 0.530-inches inclusively.

16. The apparatus of claim 1 in which the combined weights of the ceramic, adhesive, and substrate elements falls in the range between 4.00- and 5.70-pounds-per-square-foot inclusively.

ABSTRACT OF THE DISCLOSURE

10

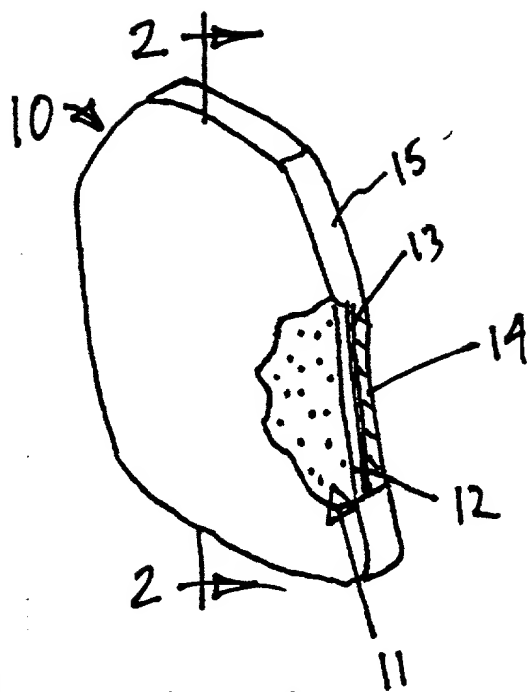


FIG. 1

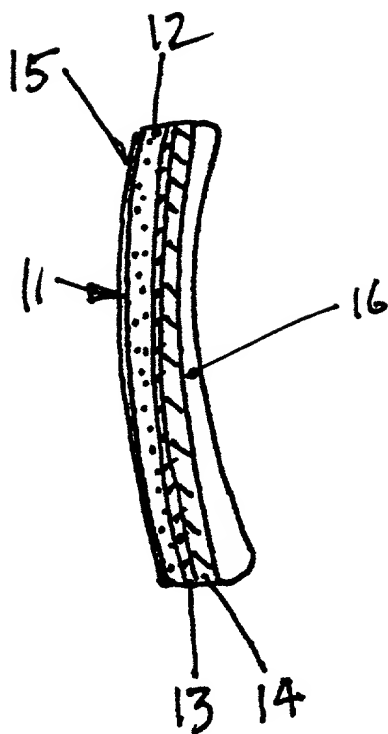


FIG. 2

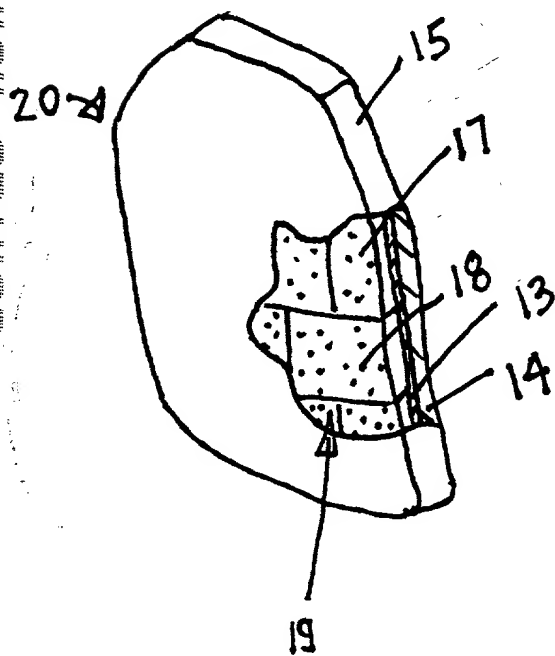



FIG. 3

W. J. Percibelli
 William J. Percibelli
 Phoenix, Arizona
 Maricopa County
 13 February 2000

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)	Attorney Docket Number	
	First Named Inventor	PERCIBALLI, William
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	
	Group Art Unit	
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing	OR	<input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)
Examiner Name		

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

CERAMIC ARMOR APPARATUS FOR MULTIPLE BULLET PROTECTION

the specification of which (Title of the Invention)

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) [] as United States Application Number or PCT International Application Number [] and was amended on (MM/DD/YYYY) [] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:


I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Customer Number

OR

☐ Registered practitioner(s) name/registration number listed below

Place Customer Number Bar Code Label here

Name	Registration Number	Name	Registration Number

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number OR ☒ Correspondence address below

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City	PHOENIX	State	AZ	ZIP	85048
Country	USA	Telephone	480-460-3431	Fax	480-517-1154

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))	Family Name or Surname
William J.	PERCIBALLI

Inventor's Signature	WJPerciballi			Date	2/19/2000		
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Post Office Address							
City	PHOENIX	State	AZ	ZIP	85048	Country	USA

☐ Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto